
Pleural Mesothelioma

Types, Causes, Symptoms, Diagnosis, and Treatments

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Abstract

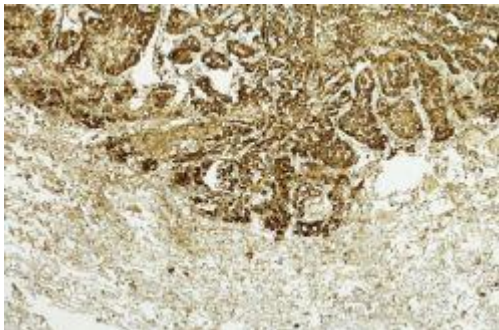
Pleural mesothelioma is a rare and aggressive cancer caused primarily by asbestos exposure, affecting the protective lining of the lungs. It is a life-altering disease that often presents challenges in diagnosis and treatment due to its late-onset symptoms. This guide provides an overview of pleural mesothelioma, covering its causes, types, symptoms, diagnosis, complications, and treatment options.

Keywords: Alimta; Asbestos fibers; Chronic cough; Chronic inflammation; Cisplatin; Complications of Pleural Mesothelioma; Decortication; Diagnosis of Pleural Mesothelioma; Epidemiology of Pleural Mesothelioma; Epithelioid mesothelioma; Extrapleural pneumonectomy;

Fluid buildup in the chest cavity; Keytruda; Living with Pleural Mesothelioma; Mixed biphasic mesothelioma; Mixed mesothelioma; Nivolumab; Opdivo; Pathophysiology of Pleural Mesothelioma; Pembrolizumab; Pemetrexed; Persistent chest pain; Pleural effusion; Pleurectomy; Prevention of Pleural Mesothelioma; Prognosis of Pleural Mesothelioma; Respiratory failure; Risk Factors and Causes of Pleural Mesothelioma; Sarcomatoid mesothelioma; Shortness of breath; Symptoms of Pleural Mesothelioma; Treatment and Management of Pleural Mesothelioma; Types of Pleural Mesothelioma; What is Pleural Mesothelioma

Introduction

Pleural mesothelioma is a severe form of cancer that develops in the pleura, the thin membrane surrounding the lungs. Most cases are linked to inhaling asbestos fibers, which can remain in the body for decades before causing harm. Despite being a rare disease, it significantly impacts those diagnosed and their families, making awareness and understanding vital. This guide seeks to educate readers about every aspect of pleural mesothelioma, providing clear information to aid in early detection, effective treatment, and improved quality of life (1-3).



Pleural mesothelioma is a cancer that forms in the pleura, the thin tissue layer covering the lungs and lining the chest cavity. Qualified specialists use many techniques to

diagnose mesothelioma. One of the techniques is to study a sample tissue under the microscope after staining it with specific chemicals (called immunohistochemistry). In this image, the sample is stained for the biomarker Calretinin to differentiate mesothelioma (the dark brown region). Image Credit: OGphoto from Getty Images Signature via Canva.com

What is Pleural Mesothelioma?

Pleural mesothelioma is a cancer that forms in the pleura, the thin tissue layer covering the lungs and lining the chest cavity. This disease is primarily caused by exposure to asbestos, a group of fibrous minerals once widely used in construction and manufacturing due to their heat resistance and durability. When asbestos fibers are inhaled, they can lodge in the pleural lining, causing inflammation, scarring, and eventually cancer. Pleural mesothelioma is known for its aggressive progression and is often diagnosed in advanced stages due to vague early symptoms.

Epidemiology of Pleural Mesothelioma

Pleural mesothelioma is a global health concern, though its prevalence varies by region. It is most commonly found in industrialized nations where asbestos was heavily used during the 20th century. Men are more frequently affected than women due to occupational exposure in industries such as shipbuilding, construction, and asbestos manufacturing. The disease typically manifests in individuals over the age of 60, reflecting the long latency period of 20 to 50 years after exposure. Although regulations limiting asbestos use have reduced the incidence in many countries, cases continue to emerge due to past exposure.

Types of Pleural Mesothelioma

Pleural mesothelioma is classified into different types based on the cell structure of the tumors.

Epithelioid Pleural Mesothelioma

Epithelioid mesothelioma is the most common type of pleural mesothelioma, making up the majority of cases. This form originates in the thin tissue lining the lungs and is made up of cells that are more organized and easier to identify under a microscope. It tends to grow and spread more slowly compared to other types, which often makes treatment more effective. People with epithelioid mesothelioma typically respond better to therapies like surgery, chemotherapy, and immunotherapy. Symptoms may include chest pain, persistent cough, difficulty breathing, and fluid buildup in the lungs.

Sarcomatoid Pleural Mesothelioma

Sarcomatoid mesothelioma is a rare and aggressive form of pleural mesothelioma. It develops from spindle-shaped cells that are less structured and more difficult to treat. These cells do not stick together as tightly as those in epithelioid mesothelioma, allowing them to spread more rapidly throughout the lungs and nearby tissues. Sarcomatoid mesothelioma is more resistant to treatment, and patients may have fewer options for surgery and chemotherapy. Symptoms often include severe shortness of breath, chest pain, fatigue, and unintentional weight loss. Because of its aggressive nature, early detection is crucial, though treatment mainly focuses on relieving symptoms and improving quality of life.

Mixed or Biphasic Pleural Mesothelioma

Mixed or biphasic mesothelioma is a combination of epithelioid and sarcomatoid cells, meaning it has characteristics of both types. The behavior of this form depends on the ratio of the two cell types. If epithelioid cells are more dominant, the cancer may be less aggressive and respond better to treatment. If sarcomatoid cells are more

prevalent, the disease may spread more quickly and be harder to treat. Symptoms of biphasic mesothelioma include chronic cough, fluid buildup in the lungs, chest tightness, and fatigue. Treatment approaches depend on the balance of cell types and how far the disease has progressed.

Risk Factors and Causes of Pleural Mesothelioma

The primary cause of pleural mesothelioma is asbestos exposure. Inhaled asbestos fibers embed in the pleura, where they cause chronic inflammation and cellular damage over time. Occupations in construction, shipbuilding, and industrial manufacturing carry the highest risks. Secondary exposure, where family members are exposed to fibers brought home on clothing, also occurs. Genetic factors can increase susceptibility; for instance, mutations in the BAP1 gene have been associated with a higher risk of developing mesothelioma. Smoking does not directly cause pleural mesothelioma but can worsen respiratory conditions in those exposed to asbestos.

Symptoms of Pleural Mesothelioma

The symptoms of pleural mesothelioma often develop gradually and can be mistaken for less severe conditions. Common symptoms include persistent chest pain, shortness of breath, and a chronic cough. Fluid buildup in the chest cavity, known as pleural effusion, is another hallmark symptom, causing chest tightness and breathing difficulties. Fatigue, weight loss, and fever are also frequently reported. Due to the nonspecific nature of these symptoms, they are often overlooked until the disease has advanced, underscoring the importance of early medical attention for persistent respiratory issues.

Pathophysiology of Pleural Mesothelioma

The development of pleural mesothelioma begins when asbestos fibers are inhaled and become lodged in the pleura. These fibers cause chronic inflammation, which triggers genetic and cellular damage over time. Mutations in genes such as TP53, BAP1, and CDKN2A disrupt normal cell growth and repair mechanisms, leading to uncontrolled cell proliferation and tumor formation. The cancerous cells invade surrounding tissues, impairing lung function and spreading to other parts of the body. This aggressive progression makes pleural mesothelioma particularly challenging to treat.

Diagnosis of Pleural Mesothelioma

Diagnosing pleural mesothelioma involves multiple steps, starting with a detailed medical history to assess past asbestos exposure. Imaging tests, such as chest X-rays and CT scans, can reveal abnormalities like pleural thickening or fluid accumulation. A biopsy, where a tissue sample is extracted from the pleura, is essential for confirming the diagnosis. Advanced techniques, including immunohistochemistry and molecular testing, help identify specific biomarkers and cell types, aiding in accurate classification.

Complications of Pleural Mesothelioma

Pleural mesothelioma can lead to numerous complications, including respiratory failure caused by extensive tumor growth and fluid buildup in the chest cavity. The spread of cancer to nearby organs can impair their function, resulting in additional symptoms. Pain management becomes a significant challenge as the disease progresses, and treatments such as chemotherapy

and radiation therapy may cause side effects like fatigue, nausea, and weakened immunity. Emotional and psychological burdens, including anxiety and depression, are also common among patients and their families.

Treatment and Management of Pleural Mesothelioma

Treatment for pleural mesothelioma depends on factors such as the stage of the disease, tumor type, and patient health. Surgery, such as pleurectomy/decortication or extrapleural pneumonectomy, may be performed to remove cancerous tissue and alleviate symptoms. Chemotherapy, with drugs like pemetrexed (Alimta) and cisplatin, is a standard treatment that can slow disease progression. Radiation therapy may be used to target tumors or manage pain. Immunotherapy, using drugs like nivolumab (Opdivo) and pembrolizumab (Keytruda), is emerging as a promising option. Palliative care focuses on improving quality of life through symptom management and emotional support.

Prognosis of Pleural Mesothelioma

The prognosis for pleural mesothelioma is generally poor, with an average survival time of 12 to 21 months after diagnosis. Factors influencing prognosis include the type of mesothelioma, the stage of the disease at diagnosis, and the patient's overall health. Advances in treatment, including immunotherapy and targeted therapies, are improving outcomes for some patients. Early detection and a multidisciplinary approach to care are critical for achieving the best possible results.

Prevention of Pleural Mesothelioma

Preventing pleural mesothelioma primarily involves minimizing asbestos exposure. This includes following strict workplace safety regulations, using protective equipment, and ensuring proper removal and disposal of

asbestos-containing materials. Public health campaigns to raise awareness about asbestos risks and advocate for its global ban are essential. Individuals with a history of asbestos exposure should undergo regular health screenings to detect potential issues early, improving the chances of effective intervention.

Living with Pleural Mesothelioma

Living with pleural mesothelioma presents significant physical, emotional, and financial challenges. Symptom management, psychological support, and lifestyle adjustments can help improve quality of life. Building a support network that includes family, friends, healthcare providers, and patient advocacy groups is crucial. Participation in clinical trials may provide access to innovative treatments, offering hope for improved outcomes. Maintaining open communication with healthcare teams ensures that care is tailored to the patient's needs and preferences.

Conclusion

Pleural mesothelioma is a complex and life-altering disease that requires comprehensive care and support. Understanding its causes, symptoms, and treatment options is vital for early detection and effective management. Advances in medical research are providing new hope for patients, but prevention remains the most effective strategy.

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